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No. 9

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Earth Sciences

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METEOROLOGY

IMPROVED IF-1 PHOTOMETER FOR RANGE-OF-VISIBILITY MEASUREMENTS

[Article by Ye. L. Bor, V. Ye. Karpusha and R. A. Kruglov, "Experimental
Model of the IF-1 Pulsed Photometer"]

[Abstract] RDV-2 and RDV-3 instruments are widely used at the present time
in the network of aviation meteorology stations. The development of a new
instrument was dictated by the need for broadening the range of measure-
ment of the meteorological range of visibility, decreasing the errors in
remote transmission of the measurement results and increasing operational
reliability. Two or three photometers with different measurement bases
are often used for broadening the measurement range; this has serious dis-
advantages. The use of a single photometer involves great difficulties,
but this problem has now been solved in the IF-1 photometer described here.
In this instrument there is a diaphragm with two apertures (corresponding
to the number of reflectors) in the focal plane of the receiving mirror.
Figure 1 in the text is an optical diagram of the instrument. The light
flux from a pulsed light source, situated in the focus of the objective,
is directed in the form of a slightly divergent beam toward prism reflec-
tors, constituting the measurement flux. The light flux returned by the
prism reflectors is incident on a receiving mirror in whose focus is situ-
ated the first diaphragm. The second diaphragm is situated alongside. The
diaphragms are alternately opened. Figure 2 in the text is a block diagram
of the instrument. The annotated figures serve as the basis for the detail-
ed textual description of structure and functioning of the photometer.
The instrument contains no electromechanical units and the number of optical
parts is substantially reduced. Preliminary tests indicate that it will
be convenient and reliable in operation, at the same time having a substan-
tially broader measurement range, a linear output of the meteorological
range of visibility and a higher accuracy of remote transmission of the
measurement results. Figures 2; references: 8 Russian.
[367-5303]

PROCESSING OF METEOROLOGICAL DATA IN AUTOMATED AIR TRAFFIC CONTROL SYSTEM

[Article by Yu. V. Vinogradov, Yu. F. Moiseyev, N. A. Petrov and A. I. Plesnev, "Principles for the Exchange of Meteorological Information in an Automated Air Traffic Control System"]

[Abstract] The article discusses the basic principles for constructing an automated meteorological support system (ASMO -- avtomatizirovannaya sistema meteorologicheskogo obespecheniya), the requirements on the content of information and the principal forms of "input" meteorological communications in an automated air traffic control system (AS UVD -- avtomatizirovannaya sistema upravleniya vozdushnym dvizheniyem). A structure of input meteorological communications has been developed for accomplishing automated data processing. Some changes in the presently employed FAP and APP meteorological aviation codes are proposed in order to simplify the automated processing of data coded using these codes. The article also gives examples of formalized meteorological communications transmitted to the air traffic control automated meteorological support system. References: 3 Russian.
[367-5303]

ERROR OF SCATTERED-LIGHT PHOTOMETERS CAUSED BY LIGHT ATTENUATION

[Article by V. N. Adnashkin, "Error of Scattered-Light Photometers Caused by Light Attenuation"]

[Abstract] The author has analyzed the contribution of light attenuation in the investigated medium along the light source-scattering volume-photodetector path and on the outer surfaces of the optical elements of nephelometers to the measurement results. It is shown that in two-channel nephelometers with a fixed observation angle $\varphi \neq 180°$ an allowance for light attenuation during transmission through the investigated medium and elimination of the measurement error caused by light attenuation on surfaces can be accomplished by the appropriate construction of a reference optical channel. In backscattering nephelometers ($\varphi = 180°$) attenuation of the flux along the path must be taken into account by the calibration curve. Tables 1; references: 5 Russian.
[367-5303]

PROCESSING, STORAGE AND DISPLAY OF DATA IN AIR TRAFFIC CONTROL SYSTEM

[Article by Yu. V. Vinogradov, A. Ye. Veselkin, Yu. F. Moiseyev and A. I.
Plesnev, "Sequence for the Processing, Storage and Display of Meteorolog-
ical Information in an Automated Air Traffic Control System"]

[Abstract] The article examines the problems involved in the processing,
storage and display of meteorological information in a unified automated
air traffic control system. The authors present a fully detailed descrip-
tion of the sequence of passage of meteorological information through the
central computer complex of the automated system, its documentation and
preparation for display at the working places of air control personnel. The
approximate procedures for the work of meteorological specialists in pre-
paring, checking and correcting the meteorological information appearing
on the display are outlined. The described approach speeds up the delivery
of meteorological information to users and frees control personnel from
repeated reference to it, and this in turn increases the reliability of
meteorological support and safety of flight operations. (This is a companion
article to the paper "Principles for the Exchange of Meteorological Infor-
mation in an Automated Air Traffic Control System," by Yu. V. Vinogradov,
et al., in this same collection of articles, pp 3-9.) References: 5 Rus-
sian.
[367-5303]

OCEANOGRAPHY

EFFECT OF WIND WAVES ON TEMPERATURE AND VELOCITY FLUCTUATIONS IN
ATMOSPHERIC SURFACE LAYER

[Article by O. A. Kuznetsov and D. A. Larin, Institute of Oceanology, "In-
fluence of Sea Wind Waves on the Spectra of Temperature and Velocity Fluc-
tuations in the Near-Water Layer of the Atmosphere"]

[Abstract] The variability of the form of spectra of fluctuations of tem-
perature and the vertical component of wind velocity, measured from a plat-
form on the Caspian Sea at a distance of 20 km seaward of Artem Island, is
investigated. Waves exert the most significant influence on the structure
of hydrodynamic fields under conditions of approximately neutral stratif-
ication. Their influence is expressed not only in the range of frequencies
of the principal energy-carrying components of waves, but also at higher
and lower frequencies: the slope of the spectra in the high-frequency inter-
val varies from more gently sloping than the "-5/3 law" in the case of de-
veloping waves to steeper in the case of attenuating waves and swell. In
the low-frequency range the dimensionless spectral density decreases with
an increase in the dimensionless height of measurements $k_0 z$ (k_0 is the wave
number of the fundamental harmonic of the wave spectrum). With an increase
in the dimensionless height of measurements the form of the spectra ap-
proaches the typical for the surface air layer. Figures 5; references 11:
6 Russian, 5 Western.
[344-5303]

BAROTROPIC ROSSBY WAVES IN A ZONAL FLOW WITH SHEAR

[Article by G. A. Grishin, "Barotropic Rossby Waves in a Zonal Flow With Shear"]

[Abstract] Within the framework of a linear formulation of the problem, a study was made of the mechanism of interaction between a free Rossby wave and a zonal flow. The effects of radiation and entrapment of wave energy in the neighborhood of a shear current were discovered. The first case is characterized by a marked change in the density of kinetic energy in a meridional direction, which is in qualitative agreement with data from experimental investigations carried out under the POLYMODE program. It is shown that the patterns of meridional distribution of momentum and density of kinetic energy in a general case are essentially dependent on the relative vorticity gradient. References 7: 2 Russian, 5 Western.
[350-5303]

EFFECT OF SURFACE-ACTIVE SUBSTANCES ON SKIN TEMPERATURE OF OCEAN

[Article by G. L. Luchnik, "Influence of Surface Active Substances on Skin Temperature of Ocean (Experiment With an Artificial Slick)"]

[Abstract] Petroleum products spread quite rapidly on a water surface, forming a thin film. Visually sectors of a sea surface contaminated by surface-active substances are observed as areas of a relatively smooth surface (slicks). The author has investigated the influence of surface-active substances of the oil film type on the skin temperature. An experiment was carried out in the Black Sea in December 1978 at a distance of 6 miles from the shore. The temperature field was investigated using scanning instrumentation operating in the IR range which makes it possible to obtain the heat pattern of the sea surface. The principal technical specifications of the instrument were: resolution with respect to angle of field of view 4°; response to temperature contrast not worse than 0.1°C; working spectral range $3.5-5.2\mu$m. The scanning head was mounted on a boom with a length of 2 m at the prow. An artificial slick was created for the experiment. The interpretation of slick - clean surface thermal photographs involved identification of radiobrightness and thermodynamic contrasts. Only a qualitative evaluation of the temperature contrast was made. The central region of the slick was not interpreted because the film thickness in this region is greater than 0.5μm. The change in heat flow through the surface in the

presence of surface-active substances is examined. A formula is derived
which can be employed in estimating the slick - clean surface contrast.
Figures 1; references 12: 4 Russian, 8 Western.
[350-5303]

CHARACTERISTICS OF REMOTE SOUNDING INSTRUMENTS WITH INTERNAL NOISE

[Article by M. G. Poplavskaya, "Characteristics of Remote Sounding Instru-
ments With Internal Noise"]

[Abstract] The author analyzes the increase in resolution of remote instru-
ments which can be achieved by the optimum correction method applied to
their output signals, taking internal noise into account. The theoretical
aspects of solution of this problem were presented in an article by S. V.
Dotsenko, et al. in MORSKIYE GIDROFIZICHESKIYE ISSLEDOVANIYA, No 1, pp 125-
128, 1977, which described the correction method applicable to an additive
mixture of signal and internal noise (the noise being assumed to be white
and uncorrelated with the signal), first transmitted through an RC filter.
Expressions were derived for the spectrum of the instrument correction
function and the gain in measurement accuracy on the assumption of homo-
geneity, isotropicity and a "frozen-in" character of the field. As an ap-
plication of the results it is possible to use theoretical models of the
field and instrument function, whose spectra have the form of a Gaussian
curve. The advantage of such models is the possibility of representing
the investigated characteristics in simple analytical form. It is shown
here that optimum correction always gives a gain in measurement accuracy
and this increases with a decrease in the radius of a resolution element.
With optimum correction there is a maximum increase in the signal-to-noise
ratio for fields with a steeper spectrum and also when there is consider-
able noise and a small value of the time constant for the RC filter. An
increase in the time constant for the RC filter and a decrease in noise
leads to a broadening of the corrected signal transmission band. Figures
3, tables 2; references: 7 Russian.
[350-5303]

RELATIONSHIPS BETWEEN QUASI-ISOTHERMIC LAYER AND THERMOCLINE IN ONE-
DIMENSIONAL MODEL OF OCEAN ACTIVE LAYER

[Article by A. S. Ksenofontov and A. I. Pel'zenbaum, "Analytical Investiga-
tion of Relationships Between the Quasi-Isothermic Layer and the Thermo-
cline in a One-Dimensional Model of the Ocean Active Layer"]

[Abstract] The authors have found analytical solutions of the problem of
determining temperature of the ocean surface, the thickness of the quasi-
isothermic layer and the temperature of the thermocline for the horizon-
tally homogeneous active layer of the ocean when a temperature jump layer
is present. A solution is obtained for anti-entrainment and entrainment re-
gimes when there is a constancy of the heat flow and wind at the ocean sur-
face. Such factors as the formation of new quasihomogeneous layers, free
and forced convection are taken into account. The analytical solutions
show that adaptation to external factors in both cases occurs, to all in-
tents and purposes, during a synoptic period. Figures 3; references: 3
Russian.
[350-5303]

METHOD FOR MEASURING FIELD OF GAMMA RADIATION IN SEA WATER

[Article by I. F. Lukashin, V. N. Yeremeyev, G. F. Batrakov, A. M. Vinni-
kov and A. V. Kukharchik, "Complex Method for Measuring the Field of γ-
Radiation in Sea Water"]

[Abstract] A method for simultaneous registry of the spectra of cascade
and total γ - background radiation in sea water is described; the method
also makes it possible to ascertain the anisotropy of this radiation in
the case of in situ measurement. Data are presented for computing instru-
ment geometry, on the basis of which a model of a three-channel γ - com-
plex was constructed. The method involves application of fast γ-spectro-
metry of medium radiation by this multichannel instrument with identical
and independent channels and statistical processing of the maximum volume
of spectrometric data using an electronic computer. Figure 1 in the text
is a block diagram of the instrument complex. The method used in rejecting
the background is fully explained. The complex has a low level of internal
noise. The applied principle of spatial-temporal and energy rejection of
the background of interfering radiation on the basis of multichannel spec-
trometry is shown to bring about a considerable broadening of the possib-
ilities for measuring low activities of sea water. Figures 5; references
16: 10 Russian, 6 Western.
[350-5303]

NONLINEAR EFFECTS IN QUASIHOMOGENEOUS LAYER AND MAIN PYCNOCLINE LAYER

[Article by V. V. Knysh and I. G. Protsenko, "Nonlinear Effects in the Quasihomogeneous Layer and the Layer of the Main Pycnocline in the Sea"]

[Abstract] The authors give a nonlinear theoretical model for use in studying the synoptic variability of the current and density fields in the sea; processes in the upper quasihomogeneous layer are taken into account. The article gives a numerical algorithm of the model and presents numerical computations of the fields of currents, density and coefficient of vertical turbulent exchange in the Golfe du Lion with the use of real data on the density field and atmospheric pressure. It is demonstrated that nonlinear effects are important in the upper quasihomogeneous layer and small in the main pycnocline. It was found that an adynamic level correction exerts a substantial influence on the formation of currents in the sea. In this paper the boundary conditions for the horizontal components of velocity and density are not entirely precise. It is noted that a dynamic-stochastic approach is preferable for computation of nonstationary problems in polygons where there are several density surveys. This study was based on data collected during the Soviet-French expedition "Sovfrans II" (June-July 1976). Figures 4; references: 11 Russian. [350-5303]

MANIFESTATION OF SEA WAVES IN STATISTICAL AND SPECTRAL CHARACTERISTICS

[Article by G. N. Khristoforov, V. Ye. Smolov and A. S. Zapevalov, "Manifestation of Nonlinearity of Surface Sea Waves in Statistical and Spectral Characteristics"]

[Abstract] Experimental investigations of sea waves in the presence of a weak wind are discussed. When there is a weak wind the wave spectrum does not attain saturation and as a result there may be significant variations in the spectral density level at high frequencies. In the spectrum it is possible to distinguish wave systems: locally excited and arriving from other regions of the sea. Wind instability and gusts evidently exert an influence for the most part on the capillary region of the spectrum (third and fourth spectral intervals). Short-period ripples on the wave records can appear "trochoidal" (T structure) in the course of some time intervals alternating with other intervals when the ripples appear to be "sinusoidal" (S structure). Changes in the characteristics of short-

period ripples can be judged from the change in the statistical coef-
ficients of the distribution (asymmetry, excess, Cornu coefficient). In
addition, the T-structure is characterized by a higher specific content
of harmonics in the spectrum, that is, a greater nonlinearity in compar-
ison with the S structure. It can be postulated that the observed variabil-
ity of structure is caused by nonlinear interactions in the waves, such
as interaction of surface waves with currents and internal waves. Figures
4, tables 1; references 18: 9 Russian, 9 Western.
[350-5303]

THERMAL STATE OF THE COLD SKIN LAYER

[Article by V. N. Kudryavtsev and G. L. Luchnik, "Thermal State of the
Cold Skin Layer"]

[Abstract] The phenomena transpiring in the cold skin layer are very com-
plex with respect to their internal mechanism and therefore it is very
difficult to describe them within the framework of the general hydrody-
namics of the upper boundary layer of the ocean. Accordingly, in this
article, within the framework of a very simple analysis of the laminar
sublayer under the free surface of a cooling fluid, the author determines
the correlation between the heat flow through the free surface and the dy-
namic velocity at which a change in the thermal state of the sublayer oc-
curs. It is shown that with a definite dynamic velocity value in the thin
subsurface layer there is a change from free to forced convection, which
leads to a different functional dependence of the mean temperature drop on
external parameters. The authors give a comparison of the theoretical
critical velocity value and the experimental value obtained by A. I. Ginz-
burg and K. N. Fedorov in IZVESTIYA AN SSSR, FIZIKA ATMOSFERY I OKEANA,
14, No 7, pp 778-785, 1978. References 11: 3 Russian, 8 Western.
[350-5303]

METHOD FOR MEASURING FREQUENCY-ANGLE SPECTRA OF WIND WAVES

[Article by Yu. P. Solov'yev and V. V. Yefimov, "Measurement of the Frequency-Angle Spectra of Wind Waves Using an Array of Wave Recorders"]

[Abstract] Methods for evaluating the frequency spectrum and spectrum of wave numbers on the basis of the results of synchronous measurements of the sea surface rise at several points are described. Measurements were made in the Black Sea in the experimental polygon of the Marine Hydrophysical Institute. Capacitance-type string wave recorders were used. These instruments were attached to two stationary masts in the open part of the sea at a depth of 15 m at a distance of 300 m from the shore. Wind velocity and direction were registered simultaneously at a height of 10 m; the horizontal and vertical components of velocity of water motion under the surface of the waves were registered. The velocity components were measured by means of reversible orbital velocity sensors. The authors compare the traditional method and the maximum probability method in evaluations of models of the angle spectrum. Experimental evaluations of the frequency-angle spectra of wind waves in the shore zone of the open sea are given for the case of a stable wind field. The difference between these evaluations and known approximations of the angular distribution functions for the energy of wind waves is analyzed. Figures 5; references 13: 6 Russian, 7 Western.
[150-3303]

PARAMETERS OF ANTENNAS AND RADIO CHANNEL FOR SEA BUOYS

[Article by V. S. Nazarov and M. N. Pen'kov, "Selection of Transmitting Antennas and Working Frequencies of Radio Channel for Sea Buoys"]

[Abstract] The article gives a concise comparative evaluation of several types of transmitting antennas for use on sea buoys, followed by recommendations on the optimum working frequencies for these antennas. A table gives the efficiencies of collapsible-whip antennas and types with upper current supply for lengths of 4 and 6 m; the efficiency of the latter type was found to be several times greater than for the first type. It was noted that for transmitting data from an autonomous buoy for a distance up to hundreds of kilometers preference must be given to antennas with upper current supply. The optimum working frequency must be found on the basis of the known distance and the parameters of the antenna circuit. Antennas

operating at ultrashort waves and magnetic antennas may be preferable to others at short distances and under specific conditions. Figures 1, tables 1; references: 4 Russian.
[350-5303]

STRUCTURE OF SYNOPTIC VARIABILITY DETERMINED IN "POLYMODE" POLYGON

[Article by B. A. Nelepo and G. K. Korotayev, "Structure of Synoptic Variability According to Data from Hydrological Surveys in the 'Polymode' Polygon"]

[Abstract] Large-scale eddies were investigated during the Soviet-American "Polymode" experiment. This involved hydrological surveys in a polygon measuring 306 x 306 miles, which is considerably greater than the extent of an individual eddy. The data collected by ships of the Marine Hydrophysical Institute demonstrated that in the polygon there was some rapidly changing background with relatively small movements of isosurfaces and strong long-lived formations -- synoptic eddies. The eddy field cannot be called closely packed because it occupied an average of only 35-40% of the area of the polygon. In the ocean there is a wave field and strong eddies propagating over this background. Eddies are only one of the forms of synoptic variability. However, since the energy of baroclinic disturbances is proportional to the square of movement of the isopycnic surfaces, most of the energy at synoptic scales is precisely in eddy formations, despite their relative dispersal over the ocean area. The distinguishing characteristic of the synoptic eddies is the considerable velocity of their orbital motion, which substantially exceeds the phase velocity of their movement. In this article the authors present simple mathematical models of evolution of strong isolated eddies and the dynamics of the rapidly changing background. Figures 2; references 20: 9 Russian, 11 Western.
[350-5303]

PREDICTION OF UPPER QUASIHOMOGENEOUS LAYER

[Article by V. I. Klimok, V. A. Sukhorukov and N. Z. Khlystov, "Prediction of the Upper Quasihomogeneous Layer in the "Jasin" Experiment"]

[Abstract] The research ship "Akademik Vernadskiy" participated in the international experiment "Jasin" during the period 21 August-5 September. The objective was study of the physical processes of interaction between

the boundary layers of the atmosphere and ocean. In the low and middle latitudes during the entire year there is a quasihomogeneous layer and a seasonal thermocline. The boundary between the seasonal thermocline and the quasihomogeneous layer is usually a clearly expressed temperature jump layer. The quasihomogeneous layer directly interacts with the atmosphere through the surface wave layer. Sounding data collected during the expedition indicate a very high variability of depth of the arbitrarily defined temperature jump (from 20 to 70 m). Various situations were observed and are described in detail. It was found that an increase in wind velocity increases the thickness of the turbulent surface layer and vice versa. There is a lag in the reaction of the temperature jump relative to the wind change. The authors formulate a model which correctly represents the general trend of behavior of the quasihomogeneous layer. Figures 4; references 5: 3 Russian, 2 Western.
[350-5303]

EFFECT OF SEA ELECTROSTRATIFICATION ON WAVE MAGNETIC FIELDS

[Article by V. P. Smagin and V. N. Savchenko, Far Eastern State University, "On the Influence of Sea Electrostratification on the Magnetic Fields of Wind Waves"]

[Abstract] A study was made of the magnetic fields generated by the space potentials of wind waves in the southern seas where the conductivity of sea water is vertically nonuniform, approximated by a function which diminishes exponentially with depth. The amplitudes of the induced vertical magnetic field at the sea surface are compared with homogeneous and inhomogeneous conductivities. The average homogeneous conductivity is found such that the integral conductivities of the entire thickness of the ocean with homogeneous and inhomogeneous conductivities are equal. Simple formulas are given for comparing the amplitudes and an analysis of the influence of electrostratification shows that it exerts an appreciable influence at certain wavelengths and at certain depths. Tables 1; references 3: 1 Russian, 2 Western.
[345-7872]

SCIENTIFIC RESEARCH WORK IN THE PACIFIC OCEAN

[Article by M. L. Krasnyy, G. I. Anosov and Yu. V. Shevaldin, "Pacific Ocean Expedition of the Scientific Research Ship 'Morskoy Geofizik' and the Hydrographic Ship 'Fedor Matisen' (1978-1979)"]

[Abstract] The Pacific Ocean Geophysical Expedition of the Sakhalin Multi-discipline Scientific Research Institute and the Pacific Ocean Oceanolog-ical Institute was carried out aboard the scientific research ship "Morskoy Geofizik" and the hydrographic ship "Fedor Matisen." The expeditionary work of the first lasted from 1 December 1978 through 2 March 1979 and the work of the second lasted from 16 December 1978 through 27 February 1979. The investigations were made within the framework of the program for study of the marginal sea - island arc - abyssal trench - ocean floor system in the northwestern and western parts of the Pacific Ocean, a component part of the USSR national program carried out within the framework of the Inter-national Geodynamic Project. The objects of direct investigations were the regions of the Yap island arc and the abyssal Philippines trench. (Figures 1 and 2 are fold-out maps showing the tracks of the vessels.) The main ob-jective of the "Fedor Matisen" was carrying out areal geophysical surveys, including gravimetry, magnetometry and depth measurements. The "Morskoy Geofizik" carried out investigations by the refracted waves method on ref-erence runs, collecting information on the physical parameters of the medium; along a number of profiles there was continuous seismic profiling by the central ray method. In runs between polygons both ships carried out gravimetric, magnetometric and depth measurements. The collected data will make it possible to construct maps of bottom relief, gravity and magnetic fields. A characteristic feature of distribution of the gravitational field is a general negative background. A number of local anomalies caused by individual submarine mountains were discovered. The gravity field in the Faye reduction for the polygon as a whole reflects the principal tec-tonic elements, reveals the block structure of the lithosphere in this re-gion and makes it possible to detect the principal dislocations and den-sity inhomogeneities. A distinguishing characteristic of the anomalous magnetic field is a relatively low mean intensity and the absence of any high-gradient fields. There is a relatively weak correlation with bottom relief. The maximum intensity of the individual anomalies does not exceed 400 gammas. Seismic profiling by the reflected waves method in the central ray variant revealed a sharply different structure of the earth's crust in the Yap and Kurile-Kamchatka trenches. The article describes a visit to the Volcanological Observatory at Rabaul, Papua-New Guinea and describes various kinds of geophysical work done there. Figures 3; references 4: 3 Russian, 1 Western.
[344-5303]

NINETEENTH VOYAGE OF THE "AKADEMIK VERNADSKIY"

[Article by Ye. F. Shnyukov, V. I. Starostenko and A. Yu. Mitropol'skiy, "Nineteenth Voyage of the Scientific Research Vessel 'Akademik Vernadskiy' (Geological-Geophysical Program)"]

[Abstract] During the period 21 December 1978-10 April 1979 specialists on the 19th voyage of the research vessel "Akademik Vernadskiy" carried out the first specialized geological-geophysical expedition of the Ukrainian Academy of Sciences. Its main objective was a determination of the patterns of distribution of ore formations on the floor of the tropical zone of the Indian Ocean and study of crustal structure. A figure is the text is a map of the vessel's track and the stations occupied. The expedition included 16 detachments: endogenous metallogeny and tectonics, exogenous metallogeny and tectonics, petrography, lithology, biostratigraphy, isotopic age of sediments and crystalline rocks, hydrochemistry and nuclear research methods, magnetometry, gravimetry, bottom relief and navigation, hydrochemistry, hydrology, isotopic oceanography, botany, materials science and gas investigations. Forty-three stations were occupied. Using corers with diameters of 127 and 146 mm it was possible to obtain 33 cores of bottom sediments (total length 107 m). Dredging was carried out in 24 places (successful in 18 cases); 982 kg of bedrock and 256 kg of ferromanganese nodules were raised. Some of the results were as follows. It was possible to compile a tectonic map of the Arabian Sea-Indian Ocean Ridge showing ore mineralization and reflecting essentially new information. A central rift valley was detected for the first time on the basis of an analysis of bottom relief and newly collected geophysical data. A wide range of ore mineralization was found in the bedrocks of the Arabian Sea-Indian Ocean Ridge. Ferromanganese formations were found to be extensively developed. The greatest volume of ferromanganese formations is observed in the foothills of ridges and in hilly sectors of basins. The relief of the most important structural elements of the Indian Ocean floor was studied. The total extent of the gravimetric runs was 13,400 miles; the total extent of magnetometric runs was 9,850 miles. It was possible to create a preliminary three-dimensional density model of the northern part of the Indian Ocean which was based on measurements of the gravity field averaged in areas measuring $1 \times 1°$. Analysis of available data suggests that in a number of places the generally accepted ideas concerning the geological structure of the floor are in need of serious correction. Studies were made of the speed of sound in bottom deposits and underwater photographs of the bottom were taken. Other work included study of marine tropical climate, its influence on resistance to corrosion and performance of different materials. Figures 1.
[344-5303]

VERTICAL VARIABILITY OF SMALL-SCALE OCEAN TURBULENCE

[Article by V. S. Belyayev, A. N. Gezentsvey and M. M. Lyubimtsev, Institute of Oceanology, "Vertical Variability of Small-Scale Turbulence"]

[Abstract] A distinguishing characteristic of the vertical distribution of the parameters of microstructure of hydrophysical fields in the ocean is a nonmonotonic change with depth, unquestionably attributable to variability of local background conditions. Investigation of the interrelationship between turbulence and local background conditions in the ocean is now one of the most important tasks in physical oceanology. A series of soundings with a microstructure probe (in the layer 100-500 m) was carried out during the 15th voyage of the "Dmitriy Mendeleyev" in 1975 in the zone of the southern subarctic front in the northwestern part of the Pacific Ocean, in a region with the coordinates $36°20'N$ and $149°E$. The time interval between soundings was 20 min. This article gives an analysis of synchronous records of sensors registering fluctuations of current velocity u' and mean temperature T. Specifically, a study was made of the distribution of probabilities of the current structural functions $D(r)$. It is shown that in layers with a constant vertical temperature gradient dT/dz the $D(r)$ values have a log-normal distribution for shifts of the r function belonging to the buoyancy interval when the spectrum of velocity fluctuations $E(k) \sim k^{-3}$. In a general case, when dT/dz changes, the $D(r)$ values do not have a log-normal distribution for all shifts. Figures 2, tables 1; 17 references: 12 Russian, 5 Western.
[344-5303]

WAVE-WIND INTERADJUSTMENT EFFECTS IN NEAR-WATER ATMOSPHERIC LAYER MODEL

[Article by A. Yu. Benilov and M. N. Zaslavskiy, Institute of Oceanology, "Effects of Interadjustment of Waves and Wind in a Model of the Near-Water Atmospheric Layer With Few Parameters"]

[Abstract] In earlier studies by A. Yu. Benilov, et al. (IZV. AN SSSR, FIZIKA ATMOSFERY I OKEANA, Vol 14, No 11, 1011, 1978; OKEANOLOGIYA, Vol XVIII, No 4, 587, 1978; I S"YEZD SOVETSKIKH OKEANOLOGOV. TEZISY DOKL., No 1, Moscow, 89, 1977) the authors proposed a model of interaction between waves and the wind based on use of the integral laws of conservation of energy and momentum in the wave-wind system and approximation of the profile of mean wind velocity and the spectrum of waves by stipulated functions of several parameters, the dependence of which on time is subject to determination from these conservation laws. Continuing this earlier work, in this paper the authors examine corollaries of the integral laws of conservation and momentum in the wave-wind system, relating to

the dependence of the principal characteristics of the near-water atmospheric layer (thickness of the sublayer of interactions, roughness parameter, friction velocity, drag coefficient, etc.) on the degree of development of wind waves. Figures 8; references 6: 4 Russian, 2 Western.
[344-5303]

MODEL OF INTERMITTENCE OF OCEAN TURBULENCE

[Article by M. M. Lyubimtsev, Institute of Oceanology, "Model of Intermittence of Ocean Turbulence"]

[Abstract] External intermittence is the nonuniformity of distribution of turbulent energy in a flow with "spots" of turbulent fluid sporadically arising in it. In the experimental investigation of turbulence in the ocean the records of signals of the measured parameters (fluctuations of velocity, temperature, etc.) by low-inertia sensors have the form of alternating pulses (of different shape and width), separated by noise intervals of irregular duration. Such pulse modulation of signals is a result of external intermittence of turbulence. In this paper, for describing this type of signals, the author proposes an elementary model within whose framework it is possible to examine the influence of the parameters of external intermittence on some statistical characteristics of small-scale turbulence. It is shown that the semiinvariants of the intermittent process, as well as the mean rate of dissipation of turbulent energy, are proportional to the mean intermittence coefficient. The decrease in the correlation and spectral functions with an increase in the argument is essentially dependent on the distribution of probabilities of the dimensions of the "turbulent spots." References 11: 9 Russian, 2 Western.
[344-5303]

TERRESTRIAL GEOPHYSICS

TRAVEL TIMES OF LONGITUDINAL WAVES IN UPPER MANTLE

[Article by S. D. Kogan, Institute of Physics of the Earth, "Travel Times
of Longitudinal Seismic Waves in the Horizontally Inhomogeneous Upper
Mantle"]

[Abstract] The article gives a table of travel times for P waves for Δ =
28°-103° obtained from observations of surface sources, taking into ac-
count the differences in the travel time of this wave in the crust and
upper mantle not only in the neighborhoods of the stations, but also in
the focal regions. The author gives a generalized model of time anomalies
of a longitudinal wave relative to the mean world values, cited in the
table, characterizing the large-scale horizontal inhomogeneity of upper
mantle structure. The new table of travel times of the P wave is compared
with tables prepared by other authors. Considerations are expressed con-
cerning the need for constructing averaged velocity models of structure
of the crust and upper mantle for epicentral zones of the same type which
will ensure sounder computation of the corrections to the travel times for
focal depth. Tables of travel times of the P wave for deep earthquakes in
different regions of the Pacific Ocean seismic zone are given. These were
computed taking into account the corresponding corrections in accordance
with the Jeffreys-Bullen model. Figures 4, tables 2; references 24: 6 Rus-
sian, 18 Western.
[357-5303]

INCOHERENT RADIATION OF EARTHQUAKES WITH DIFFERENT FOCAL MECHANISMS

[Article by Yu. F. Kopnichev, I. L. Nersesov and Ye. V. Medvedeva, Instit-
ute of Physics of the Earth, "Incoherent Radiation of Strong Earthquakes
With Different Focal Mechanisms"]

[Abstract] A study was made of the peculiarities of the envelopes of high-frequency teleseismic P-waves, constructed at the front of increase in amplitudes, for strong earthquakes with different types of focal movements. It was established that for shallow earthquakes (h ≤ 100 km) the laws of increase of the registered power differ substantially for different mechanisms: the power increases more rapidly for upthrusts and more slowly for faults. For deep earthquakes (h > 100 km) for all types of movements the law of increase in power is close to the similar dependence for shallow faults. A study was also made of the fine structure of the envelopes. It was found that the scatter of points relative to the averaging lines does not have a random character: intervals of slow increase in amplitude alternate with intervals of rapid increase; the durations are maximum for upthrusts and minimum for faults. The radiation of the focus of a strong earthquake consists of one or more impulses of a triangular form with a gradual increase in power and a sharp dropoff after attaining a maximum. It has now been found that the duration of these impulses is maximum for displacements and faults and minimum for upthrusts and gentle overthrusts. A comparison of the results with the conclusions following from the mechanics of destruction indicated that for upthrusts the power increases more rapidly, and for overthrusts, displacements and faults more slowly than is predicted by theory. The different physical mechanisms responsible for the detected effects were examined. An important role can be played by gravitational forces and the peculiarities of the stressed state of the medium responsible for some type of movement. It is demonstrated that the difference in the relationship of compressional and dilatational forces should lead to a dependence of the mean rate of fracturing on the focal mechanism. A study of the fine structure of the envelopes indicated that they have a zigzag character associated with variations in the rate of fissuring. Figures 5, tables 2; references 54: 32 Russian, 22 Western. [357-5303]

SCATTERING OF SEISMIC WAVES IN THE EARTH'S CRUST

[Article by M. V. Nevskiy and O. Yu. Riznichenko, Institute of Physics of the Earth, "Scattering of Seismic Waves in the Earth's Crust According to Observational Data from Areal Groups"]

[Abstract] The article gives the method and results of study of the effects of scattering of the first longitudinal waves in the earth's crust registered in the range of epicentral distances 30-230 km with predominating frequencies of the oscillations $\sim$ 8-12 Hz. A distinguishing characteristic of the experimental method is the use of dense areal recording systems with a small aperture. The authors give evaluations of the characteristics of

the scattering properties of rocks of the crystalline part of the crust.
A significant differentiation of the crystalline crust with respect to
scattering properties is established for an experimental region in the
Pripyatskiy downwarp. The authors demonstrate that scattering effects in
the earth's crust in the frequency band 8-12 Hz play a very significant
role in the process of attenuation of the energy of elastic waves with
distance. Figures 8, tables 1; references 10: 7 Russian, 3 Western.
[357-5303]

DYNAMICS OF SEISMIC WAVES IN CENTRAL KYZYLKUM

[Article by N. Kh. Abdullayev and Ye. M. Butovskaya, Institute of Geology
and Geophysics Uzbek Academy of Sciences, "Some Peculiarities of Dynamics
of Seismic Waves in the Central Kyzylkum"]

[Abstract] Special seismological observations by an extensive network of
seismic stations were made in 1976 in the Central Kyzylkum in connection
with the occurrence of the strong Gazliy earthquakes of April-May 1976 for
the purpose of investigating the nature of these earthquakes. During April-
December 1976 there was registry of about 900 earthquakes with $K > 10$ with
subsequent processing of the records and determination of focal coordinates.
Figure 1 in the text is a map of the location of the seismic stations reg-
istering the Gazliy earthquakes and their repeated tremors. The analyzed
data were used in constructing a map of the deep structure of the crust
in the region of the Central Kyzylkum. The velocities field method was
used in obtaining the averaged section of the region and a map of the dis-
tribution of velocities horizontally and in depth. Figure 2 is a diagram
of the averaged velocity section of the crust characteristic for this area.
The results of experimental and theoretical investigations of the dynamics
of the first arrivals of seismic waves are given. On the basis of a compar-
ison of the dynamic travel-time curves of the first arrivals, experimental
and theoretical, that is, precomputed from the velocity sections, it was
possible to determine their discrepancy, which was used for refining
models of structure of the earth's crust. Figures 3; references: 4 Russian.
[349-5303]

PETROLEUM-GAS DEPOSITS IN DEEP HORIZONS OF UKRAINE

[Article by R. M. Novosiletskiy, A. Yu. Polutranko, Ye. P. Savka and D. V. Sharun, Ukrainian Scientific Research Geological Prospecting Institute, "Prospects for Finding Petroleum and Gas Deposits in Deep-Lying Horizons of Petroleum and Gas Regions in the Ukraine"]

[Abstract] The possibilities of finding petroleum and gas in deep-lying horizons of sedimentary basins are dependent to a considerable degree on the thermopressure conditions in the deep layers and the position of sedimentary formations with a high content of organic matter in their cross sections. The deep-lying horizons which are most promising for petroleum and gas condensate are in regions with great geothermal "steps," that is, in the central and northwestern parts of the Borislavsko-Pokutskaya zone of the Ciscarpathian downwarp and the Dnepr-Donets Basin, and also in the northern part of the Kerch Peninsula and in the southern part of the Sea of Azov. The deeply-lying horizons are promising for petroleum, gas condensate and gas in the petroleum- and gas-bearing basins and their zones with a thickness of the deposits from 4.5 to 10 km, and also in the peripheral parts of the zone of anomalously high stratum pressures where the thickness of the sedimentary formations exceeds 10 km. The deeply situated horizons in structures with hydrodynamic windows in the zone of anomalously high pressures which are promising for petroleum and gas condensate are the wings and periclinal parts of folds in which there are conditions for the formation of hydrodynamically screened deposits. Deep-lying horizons with a high content of organic matter, covered with strata of evaporites, are highly promising. Figures 3; references 8: 7 Russian, 1 Western.
[368-5303]

STUDY OF CRIMEAN TECTONICS IN RELATION TO EARTHQUAKE PREDICTION

[Article by L. S. Borisenko, G. N. Bugayevskiy, P. S. Karmazin and E. P. Tikonenkov, Institute of Mineral Resources Geology Ministry Ukrainian Academy of Sciences and Geophysical Institute Ukrainian Academy of Sciences, "Analysis of Tectonic Activity of the Territory of the Southern Coast of the Crimea in Relation to the Prediction of Earthquakes in the Crimean Seismogenic Zone"]

[Abstract] A detailed analysis of the tectonic and especially the neotectonic activity of seismically dangerous areas is an indispensable part of research on earthquake prediction. The most informative geological formations for such purposes are dislocations and the blocks which they separate. This article therefore gives a detailed retrospective analysis of

dislocations in the area of the southern coast of the Crimea directly adjacent to the Crimean seismogenic zone, together with an interpretation, taking into account the results of tiltmeter observations in Crimea. In this area there is a marked predominance of block and fault tectonics over plicative structures, represented by different types of folds along faults or folded-block formations of the graben-syncline and horst-anticline type. A distinguishing characteristic of the regional field of stresses is its great stability, manifested in inheritance of orientation of the dislocations. Another characteristic of this tectonic field of paleostresses is a considerable duration of its existence -- from the Mesozoic to the Anthropogene. The pattern of dislocations in the area is reviewed in detail, followed by an analysis of tiltmeter measurements which have been made in the area since 1954. These tiltmeters register movements of the blocks separated by the faults and together with the pattern of dislocations form the mass of data on the basis of which earthquake prediction becomes possible. However, it is stressed that the siting of tiltmeters is a critical factor, being as important as the measurements themselves, since if they are not positioned properly in relation to faults their readings will be of little or no value. Figures 4, tables 2; references: 8 Russian.

[368-5303]

DIGITAL PROCESSING OF EXCHANGE REFLECTED WAVES

[Article by T. V. Nefedkina, G. P. Kondakova and L. V. Oleynik, Institute of Geology and Geophysics Siberian Department USSR Academy of Sciences and Siberian Geophysical Expedition, "Digital Processing of Exchange Reflected Waves"]

[Abstract] During 1976-1977 the Institute of Geology and Geophysics Siberian Department USSR Academy of Sciences, in collaboration with the Siberian Geophysical Expedition, developed algorithms and programs for the digital processing of exchange reflected PS waves in a common deep-point system with asymmetric readings (in contrast to monotypic waves the exchange PS wave has an asymmetric behavior of the incident and reflected rays). The degree of applicability of the derived travel-time curve equations and the dependence of the summation effect on the accuracy of stipulated critical parameters was the subject of an earlier article (T. V. Nefedkina, et al., GEOLOGIYA I GEOFIZIKA, No 3, 1980), which should be read in conjunction with this paper, which is essentially a continuation of the first. Here the digital processing programs are set forth in detail, followed by description of testing of the digital processing programs on the basis of field data. These programs were found to be superior to others for discriminating exchange waves in regions with slant discontinuities. Figures 4; references: 3 Russian.

[362-5303]

PROSPECTS FOR PETROLEUM AND GAS IN DEEP STRUCTURES OF UKRAINE

[Article by S. I. Grivnak, I. R. Susak and B. L. Krupskiy, Institute of Geological Sciences Ukrainian Academy of Sciences and Ukrainian GIPRONII-neft', "Prospects of Finding Petroleum and Gas in Deep Structures (in the Example of the Pasechnyanskoye Deposit)"]

[Abstract] At the present time the possibilities for discovering new deposits of petroleum and gas in the Ciscarpathian downwarp are associated with deep-lying structures of the lower tectonic stages. The prospects of deep structures are confirmed by the discovery of the Pasechnyanskoye petroleum deposit, associated with the fold of the same name in the third structural stage. The article gives a brief description of the Pasechnyanskoye deposit. A hypothesis is presented concerning the development in the deposit of collectors with a predominance of a fissured type of permeability. Measures are recommended which are directed to obtaining reliable initial data for calculating the reserves of petroleum and gas at great depths. Figures 1; references: 2 Russian.
[364-5303]

PETROLEUM DEPOSITS IN THE BASEMENT OF YOUNG PLATFORMS

[Article by B. G. Sokratov, Affiliate of the Northern Caucasus Scientific Research and Petroleum Production Institute, "Conditions for the Deposition of Petroleum in the Basement of Young Platforms (in the Example of Eastern Ciscaucasia)"]

[Abstract] Nineteen petroleum and gas condensate deposits have been discovered in the basement of the epi-Early Kimmerian platform in Eastern Ciscaucasia. These are situated in the arches of buried pre-Jurassic anticlines in zones of weathered and fissured metamorphic rocks of the Triassic and Upper Permian situated directly under unconformities. The thickness of the weathered zones is 5-200 m. In some cases the deposits are situated directly under the platform cover, whereas in other cases -- 300-600 m below it. It is postulated that such conditions are typical for the distribution of petroleum and gas deposits in the basement of young and ancient platforms. Figures 1; references: 2 Russian.
[364-5303]

CODA OF EARTHQUAKES IN NORTHERN TIEN SHAN

[Article by M. S. Khaydarov and V. I. Khalturin, Seismology Institute Kazakh Academy of Sciences, "Seismic Coda of Earthquakes in the Northern Tien Shan"]

[Abstract] The authors present the results of study of seismic coda waves of earthquakes in the Northern Tien Shan. Composite coda envelopes were obtained using records registered with standard long and short-period instruments. The article gives the results of study of the properties of coda waves in this region in the following ranges of times and magnitudes (energy classes) for records of SKD and SKM instruments: 30-10 000, 30-2000 sec; $M = 3-7$, $K = 8-14$. A magnitude calibration of these earthquakes was accomplished for the Tien Shan network and nomograms are given for practical use. The use of coda waves for study of the dissipative properties of the medium is illustrated. The quality values obtained for different regions by use of coda waves are compared. It is shown that the coda can be used in solving a number of different problems in seismology. Figures 5; tables 2. References 15: 11 Russian, 4 Western.
[361-5303]

EFFECTIVE REPRESENTATION OF WAVE FIELD IN SEISMIC PROSPECTING

[Article by G. M. Mitrofanov, Institute of Geology and Geophysics Siberian Department USSR Academy of Sciences, "Effective Representation of the Wave Field in Seismic Prospecting"]

[Abstract] The author gives a new description for a wave field obtained in systems of multiple overlapping observations. The representation is based on expansion of the logarithm of the spectral characteristic of the wave field in the $i-j$ coordinate, which as a result is recorded in the form of the product of the spectra of some effective filters. The latter makes it possible to obtain a quite complete description of the wave field under complex seismogeological conditions and simply linearize a model of a seismic field, using homomorphic transforms in data processing. The proposed representation generalizes the effective kinematic model and therefore can be called an effective dynamic model. It makes it possible to evaluate and take into account surface inhomogeneities with discrimination of the useful wave field component. In addition, the first of the effective filters is not dependent on the source-detector distance and accordingly it is convenient to use its spectral characteristic for solving inverse dynamic problems. References 21: 20 Russian, 1 Western.
[362-5303]

[Article by V. N. Zharkov, Institute of Physics of the Earth, "Absence of Superdeep Earthquakes and the Distribution of Viscosity and Temperature in the Earth's Mantle"]

[Abstract] In the earth there are no earthquakes with a focal depth greater than 700 km. Deep earthquakes do not have a random distribution, but are associated with places where the Benioff-Wadati-Zavaritskiy zone meets the second zone of phase transitions in the mantle at a depth of ~ 670 km. In the terminology adopted in plate tectonics, at these depths a plunging block of the plate meets resistance, and as can be judged from data on the focal mechanisms of deep earthquakes, is in a state of compression. In this paper the author demonstrates that the absence of superdeep earthquakes in the mantle can be understood by a study of the depth distribution of effective viscosity and temperature. The absence of superdeep earthquakes is attributable to the fact that the increase in stresses considerably decreases viscosity and this leads to a relaxation of stresses. As soon as mantle viscosity is reduced to $\eta < 10^{22}$ poise, it passes from a static to a convective state. Heat transfer begins and there is a marked decrease in temperature, which again favors a return of the mantle to its initial state with $\eta \ge 10^{23}$ poise. Thus, the physical conditions in the superdeep mantle ($l > 700$ km) are such that the viscosity there is maintained at the level $\sim 10^{23}$-10^{24} poise and this explains the absence of superdeep earthquakes in the mantle. Figures 1; references: 1 Western. [354-5303]

CRUSTAL AND MANTLE INHOMOGENEITIES IN THE KURILE ISLANDS

[Article by T. K. Zlobin, V. I. Fedorchenko and A. A. Popov, Sakhalin Complex Scientific Research Institute, Far Eastern Scientific Center, "Inhomogeneities in the Earth's Crust and Upper Mantle in the Southern Part of Kunashir Island (Kurile Islands) According to Data Obtained by the Earthquake Exchange Waves Method"]

[Abstract] The paper gives the first results of investigations by the earthquake exchange waves method under the arc-trench-ocean program carried out by the Sakhalin Complex Scientific Research Institute in the southern part of the Kuriles. The Kuriles are a region of very high present-day

tectonic-magmatic activity, to a considerable degree determining the struc-
ture of the depths. Directly in the studied region are the Mendeleyev and
Golovnin active volcanoes. The objective of the study was a determination
of the state of matter in the crust and mantle, the structure of the root
zones of the volcanoes and the position of their magma hearths. Investiga-
tions were made using five autonomous ASS-3 ("Cherepakha") seismic sta-
tions in the southern part of Kunashir Island at a distance of 2-5 km from
one another. The most interesting information on inhomogeneities in the
crust is obtained from an analysis of time sections. These make it possible
to discriminate regions of the absence of exchange waves in the deep sec-
tions; these are interpreted as regions of high physical homogeneity of
the medium and absence of its stratification. Three such regions are de-
fined in the crust of the studied region; their depths increase in a south-
erly direction from 8 to 20 km. Each of these is discussed in detail. Addi-
tional information on crustal and mantle structure was obtained using the
dynamic characteristics of the registered seismic waves. This work reveal-
ed that data from earthquake exchange waves are an effective means for
evaluating inhomogeneity of crustal and mantle structure. It appears clear
that the regions with absence of exchange waves are attributable to reduced
stratification, increased homogeneity and the presence of magma hearths.
The analysis of the dynamic characteristics of longitudinal and longitud-
inal-transverse waves indicated an increased attenuation of these waves
under the mentioned volcanoes and the predominant absorption of transverse
waves, caused by an increased plasticity of the matter developed there
(possibly incomplete crystallization of their peripheral magma hearths).
Figures 2; references: 5 Russian.
[354-5303]

AMBIGUITY AND MEASUREMENT ERRORS USING MSD-1M PULSED-LIGHT RANGEFINDER

[Article by G. I. Borodulin]

[Abstract] The MSD-1M pulsed-light rangefinder, which is in standard pro-
duction and extensive use, is a highly precise and compact instrument
which meets many requirements of mine surveying and geodetic work. However,
some of its parameters were selected at the critical limit, such as the
parameters determining the reliability of solution of ambiguity. This, as
well as the lack of any manuals other than the concise technical descrip-
tion prepared by the manufacturer, in many cases makes difficult the proper
use of the pulsed-light rangefinder. In order to render assistance to users
of the instrument the author here proposes working formulas for processing
the measurement results and a series of formulas for calculating the toler-
ances, monitoring the computations and analyzing the measurement errors.
These formulas were derived on the basis of the general theory of solution
of ambiguity, discussed in detail in A. A. Genike, et al., GEODEZICHESKIYE
FAZOVYYE DAL'NOMERY (Geodetic Phase-Type Rangefinders), Moscow, Nedra, 1974.
[358-5303]

SOLVING INVERSE ELECTROMAGNETIC SOUNDING PROBLEM

[Article by O. A. Khachay, Ural Scientific Center, Geophysical Institute
USSR Academy of Sciences, "Unified Method for Solving Inverse Problem
of Electromagnetic Soundings for a One-Dimensional Medium"]

[Abstract] An algorithm for regularizing the one-dimensional inverse prob-
lem in magnetotelluric sounding by means of filtering of complex impedance
values into the domain of the operator for solving the inverse problem is
applied to the solution of the inverse problem in electromagnetic sounding
using dipole excitation of a field in a one-dimensional medium in order to
develop a unified method for processing and interpreting the electromagnet-
ic field observed at the earth's surface, of both natural and artificial
origin. Boundary-value problems are examined for the three types of elec-
tromagnetic field sources most often used in geophysical research -- plane
electromagnetic wave, vertical magnetic dipole and horizontal electric di-
pole. The boundary-value problems reduce to a single boundary-value prob-
lem for uniform excitation and describe a unified operator for solving the
inverse problem. The input data are the values of the response function of
a one-dimensional medium, determined through the components of the electro-
magnetic field, assigned at the earth's surface as functions of frequency
and distance. The unified operator permits application of an approximate
algorithm used for solving the inverse problem in magnetotelluric sounding
for interpretation of electromagnetic sounding data. Interpretation by this
method does not require a priori information about the parameters of the
medium. Figures 2; references 8: 7 Russian, 1 Western.
[348-7872]

RECENT MOVEMENTS DETERMINED FROM GEODETIC AND SEISMIC DATA

[Article by A. A. Lukk, I. L. Nersesov, A. K. Pevnev and S. L. Yunga, In-
stitute of Physics of the Earth, "Recent Movements of Western Petr I Range
Based on Geodetic and Seismic Data"]

[Abstract] In this article an attempt is made to present a joint examina-
tion of geodetic, seismic and geological data on deformations of the earth's
crust at the juncture of the Pamirs and Tien Shan in the neighborhood of
Garm to provide a new description of the recent tectonics of that seismic-
ally active region. The results of laser-ranging measurements of 10 radial
geodetic lines with an average length of about 20 km, laid out in the neigh-
borhood of the western end of Petr I Range in Garmskiy Rayon of Tadzhik SSR,
are analyzed. Considerable rates of deformation along some of the measured
lines are noted. The horizontal component reaches 15-20 mm per year and
the vertical component is 5-15 mm per year. The epicenters of all known
strong earthquakes which have occurred within this particular territory
are plotted. Virtually all strong earthquakes are localized in the most
pronounced contact zones between blocks of the earth's crust with differ-
ent states of deformation and most of the earthquakes are confined to the
immediate neighborhood of the region where crustal deformation is accom-
panied by the strongest disturbance of the crust associated with signif-
icant seismotectonic displacements between crustal blocks with different
stressed states. A mechanical model of deformation of the region is propos-
ed which corresponds to the present-day tectonics. Tables 2; figures 3;
references 14: 12 Russian, 2 Western.
[348-7872]

PHYSICS OF ATMOSPHERE

RADIO WAVE REFLECTION FROM THIN E_s LAYER

[Article by T. S. Kerblay and S. F. Makarenko, Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation, "Radio Wave Reflection from a Horizontally Inhomogeneous Thin E_s Layer"]

[Abstract] The influence of horizontal inhomogeneity on the coefficient of reflection of electromagnetic waves from a thin layer is analyzed for the purpose of studying the structure of the E_s layer, which is represented as an infinite Epstein layer with a variable dielectric constant upon which a plane wave is incident at an angle. The wave equation for such a wave is derived and boundary conditions are assigned. The problem is solved in the approximation of geometrical optics. An approximate analytical solution is also given for large-scale inhomogeneities. The analysis indicates that the expressions derived by L. M. Brekhovskikh for a homogeneous layer can be used in calculating the coefficients of reflection from sporadic layers with large-scale horizontal inhomogeneities if the local characteristics of the layer at the midpoint of the trajectory are substituted into these expressions. They can also be used for interpreting experimental data on the reflection of electromagnetic waves from semitransparent E_s layers. Figures 2; references 5: 4 Russian, 1 Western.
[345-7872]

VLF PROPAGATION IN MAGNETOSPHERE

[Article by Yu. K. Alekhin and D. R. Shklyar, Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation, "Some Questions Concerning VLF Propagation in the Magnetosphere"]

[Abstract] Qualitative analytical solutions of the equations in geometrical optics are found for a theoretical analysis of VLF wave interaction with electrons in the near-equatorial zone in order to find the optimum

conditions for resonant interaction at the equator in the electrostatic mode. Emphasis is on finding these solutions and at the same time explaining some previously ignored characteristics of VLF propagation. The geometrical optics pattern of VLF propagation in the plasmosphere is analyzed on the assumption that the geomagnetic field is a dipole. The numerical calculations show that in the near-equatorial zone a wave usually becomes electrostatic. Cyclotron resonance between a wave and cold plasma particles is considered to be improbable in magnetospheric plasma, so that wave evolution must be attributed to interaction with high-energy particles. The results of the investigation may become the foundation for analyses of resonant interaction between VLF waves and electrons in the near-equatorial region of the magnetosphere since that is where whistlers are most frequently generated when the frequency is close to one-half the local gyrofrequency. Figures 3; references 9: 3 Russian, 6 Western.
[345-7872]

ATTENUATION OF SUPERLONG-WAVE FIELDS

[Article by V. N. Kuznetsov, B. A. Osochenko and Yu. V. Shtennikov, Leningrad State University, "Daytime Attenuation of Superlong-Wave Fields According to Shipboard Measurement Data"]

[Abstract] Amplitude at 17.8 and 16 Khz was measured in dependence on range in the central Atlantic. The SLW attenuation coefficients were estimated as functions of path latitude, orientation in the geomagnetic field and solar zenith angle. An expression was derived for interpretation of the experimental data. The measured daytime attenuation coefficients of the zero mode, data on experimental conditions and propagation characteristics are given in a table. The directions of changes in attenuation in the morning and evening hours are plotted. The results agree satisfactorily with previously published data. Figures 2, tables 1; references 4: 1 Russian, 3 Western.
[345-7872]

MAXIMUM USABLE FREQUENCY FADING CHARACTERISTICS ON A SW RADIO LINK

[Article by D. V. Blagoveshchenskiy, Siberian Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation, "Maximum Usable Frequency Fading Characteristics on a Short-Wave Radio Path"]

[Abstract] The fading of the maximum usable frequency in a HF radio channel is examined. The fading of signals often occurs during the propagation of decameter wavelengths during the transitional hours of the day due to

interference of at least two rays — magnetically split components, or the top and bottom rays. The signal frequency at which the described effect occurs is close to the maximum usable. The range of change of the main characteristics of fading -- depth and rate -- is analyzed as a function of the ratio of the working frequency to the maximum usable frequency. Precise time and frequency signals at 10 and 15 MHz in the carrier mode were used on a 2,800-km long northeasterly subauroral path. Propagation conditions were determined by slant sounding of the ionosphere. Statistical signal characteristics were calculated from 160 signal fading records for different frequency ratios. Propagation modes, delays between signals, frequency ratios and beam intensity are found. The average values of the propagation parameters for morning and evening hours, based on all the experimental data, are plotted. The depth and rate of fading are found to depend significantly on the frequency ratio, delay between rays and their intensities, and the main cause of maximum usable frequency fading in the absence of disturbances is interference of radio waves. Figures 2; references: 5 Russian.
[345-7872]

DETERMINATION OF ELECTRON FLUX PARAMETERS

[Article by V. I. Degtyarev and O. M. Pirog, Siberian Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation, "Determination of Electron Flux Parameters from Photometric Data and Stations for Vertical Sounding of the Ionosphere"]

[Abstract] The purpose of the article is to describe a method for calculating the parameters of the auroral electron spectrum based on data from an ionosphere station and zenith photometers with a narrow radiation pattern. The altitude of maximum ionization and peak electron concentration are found. The altitude of maximum ionization is plotted as a function of flux hardness for exponential and exponential-power primary electron energy spectra. The integral intensity ratios of the main auroral emissions are plotted as functions of hardness for exponential and exponential-power forms of the spectrum. An example is given of how to determine the spectral parameters of the energy flux for an exponential-power electron energy distribution. The method is deemed to be suitable for analyzing the evolution of spectra in time and space. Figures 5; references: 3 Russian.
[345-7872]

RAY DESCRIPTION OF SIGNAL DISTORTIONS IN PLANE-LAYERED PLASMA

[Article by A. P. Anyutin, Moscow Institute of Radio Engineering, Electronics and Automation, "Ray Description of Signal Distortions in Plane-Layered Plasma"]

[Abstract] Equations are derived which give a ray description of the distortions of radio signals for the important case of the interaction of signals with plane-layered plasma for the amplitudes and phases of the main and edge rays. The signals are generalized for the case of the reflection of a plane signal from a parabolic plasma layer and the time coordinates of the points of deviation of the main and edge rays from the plasma layer are found. The radiation patterns of the main and edge rays are illustrated. The normal amplitude of the edge rays and normal diffraction coefficient are plotted for a parabolic plasma layer. The calculated distortions of the signal envelope, reflected from a parabolic plasma layer, are illustrated. The envelope of a reflected signal represents a complex nonmonotonic curve. Figures 3; references 5: 4 Russian, 1 Western.
[345-7872]

SW PROPAGATION ON MIDDLE-LATITUDE CIRCUMGLOBAL HOP

[Article by D. I. Fishchuk and Ye. Ye. Tsedlina, Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation, "SW Propagation on a Middle-Latitude Circumglobal Hop"]

[Abstract] The fundamental propagation parameters -- absorption, radiation and descent angles, propagation time, signal mode structure and slant sounding ionograms on a circumglobal middle-latitude hop trajectory -- are analyzed for the case of radio waves which propagate by means of successive reflection from the F2 layer and from the earth's surface. The propagation parameters are also calculated at fixed points along multiple hop lines and are analyzed as functions of distance along the line from the point of radiation and of frequency. The propagation parameters are analyzed for equinoctial conditions of minimum solar activity. The adiabatic method is used for the analysis. Propagation is examined in the 10-13.2 MHz range in the southern hemisphere. The results of the study are valid for the corresponding trajectory in the northern hemisphere. The typical change in the maximum adiabatic invariants and the maximum intercept angles are plotted at 11 MHz. No allowance is made for the influence exerted on the ionogram patterns by the characteristics of the transmitting and receiving antennas, scatter from the earth and in the ionosphere and the geomagnetic field.
[345-7872]

ALLOWANCE FOR GRAVITY ANOMALIES IN ASTROGRAVIMETRIC LEVELING

[Article by Fam Khoang Lan, Institute of Geodetic, Aerial Mapping and Cartographic Engineers, "On the Problem of the Dependence of Errors in Astrogravimetric Leveling on the Extent of the Region of Allowance for Gravity Anomalies"]

[Abstract] M. S. Molodenskiy derived the following formula for calculating the errors in astrogravimetric leveling due to limitations on the region in which gravity anomalies are taken into account:

$$\left| \Delta \zeta /2 \right| \leqslant 0.11" \; \Delta \bar{g} / \rho^2 - 1,$$

where $\rho = R/\ell$; ℓ is half the distance between the end points A, B of an astrogravimetric leveling line; R is the radius of the region Σ of allowance for gravity anomalies around the line AB; Δg is the mean square value of gravity anomalies at the boundary of the region Σ, expressed in mgal. But this formula has definite shortcomings. For example, in most cases in the above formula it is required that $\rho = 2$-3, which is not always realistic. Moreover, it is of definite interest to consider cases when the region of allowance for gravity anomalies must be greatly restricted due to technical, economic or physiographic conditions. In such cases the ρ value can be close to unity or even less and the Molodenskiy formula, as written, does not give the required evaluation. Accordingly, the author has investigated this problem using the covariation analysis method and making use of materials on statistical study of the earth's gravitational field accumulated during recent years. Emphasizing cases of great restrictions on the region in which gravity anomalies are taken into account, it is shown that the ρ requirement based on the Molodenskiy evaluation is much too high. The results can be regarded as a refinement and supplement to evaluations made using the Molodenskiy formula. Tables 3; references 3: 1 Russian, 2 Western.
[359-5303]

ALGORITHM FOR DETERMINING COORDINATES OF OBJECTS IN RADIO RANGEFINDER WORK

[Article by G. M. Yakovlev, V. A. Pavlov, M. D. Edlina and V. P. Rudakov, "Algorithm for Determining the Coordinates of an Object Using the Results of Radio Rangefinder Measurements"]

[Abstract] Traditional methods for determining the coordinates of an object on the basis of the results of radio rangefinder measurements assume solution of the problem either on a plane in a Gauss projection or on the

surface of a sphere or spheroid. The plane is used when the distances involved are small, whereas when the distance between the object and ground stations is great the solution is accomplished on a sphere or spheroid. All this involves inaccuracies and difficulties which can be avoided by the following solution of the problem. The geographic coordinates of the object are determined (using the geographic coordinates of the ground stations and measured ranges) by an iteration method with the use of a spatial rectangular geocentric coordinate system. In case of necessity the computed geographic coordinates of the object are scaled into the plane rectangular coordinates of a Gauss projection. If the coordinates of the surface stations are stipulated in the plane of a Gauss projection they are first scaled into geographic coordinates. This article describes an algorithm for carrying out such operations. Its advantages are as follows. a) The algorithm is universal because it makes it possible to determine the coordinates of the object in a Gauss projection and also in geographic and geocentric coordinate systems regardless of ranges and with any location of the surface stations and work region relative to the coordinate zones of the Gauss projection and the coordinates of the ground stations can be stipulated in any of the mentioned coordinate systems. This feature of the algorithm simplifies preparation work, lessens its volume and reduces the volume of subsequent processing of the results, especially when working in the high latitudes, where the width of the coordinate zones of the Gauss projection is small. The algorithm ensures a higher accuracy in determining the coordinates of the object due to the exclusion of errors associated with reduction of the measured ranges, projection of a spheroid onto a sphere and solution of spherical triangles. b) The use of one and the same program blocks for transformation from geographic to Gauss coordinates and back makes it possible to reduce the memory volume of the specialized computer, which is especially important when using it aboard a moving craft. Figures 4; references: 3 Russian.
[359-5303]

DEPENDENCE OF REFRACTIVE INDEX ON CLIMATIC CONDITIONS IN DETERMINING
   DISTANCES TO ARTIFICIAL SATELLITE

[Article by Ye. P. Dunayenko and N. S. Zabolotnyy, Moscow Institute of Geo-
detic, Aerial Mapping and Cartographic Engineers, "Analysis of Dependence
of Refractive Index on Climatic Conditions in Determining Distances to an
Artificial Earth Satellite"]

[Abstract] The development of radio methods for determining distances to
artificial earth satellites required the development of more precise models
of the atmosphere. A biexponential model has a number of advantages because
it makes it possible to take into account variations of the dry and moist
components separately. This is an important consideration when using radio
waves for measuring distances. One of the important characteristics of ac-
curacy of the biexponental model is determination of the scale heights H_d
and H_w for the dry and moist components. In order to ascertain the depen-
dence of the change in the refractive index with altitude the authors
computed the H_d and H_w values for different meteorological conditions and
seasons of the year. In the computations use was made of radiosonde data
for the stations Dolgoprudnyy and Dikson for 1973 (a total of 725 cases).
The H_d and H_w values characterizing the degree of stratification D_0 and W_0
(refractive indices for dry air and water vapor at the earth's surface)
have a latitudinal and seasonal character. The monthly values of the scale
heights of the dry and moist components were determined. An analysis of
such data revealed that it is necessary to compute the scale heights
in the biexponential model of the refractive index for specific places. The
availability of the corresponding H_d and H_w values and the values of the
meteorological parameters at the earth's surface will make it possible to
obtain the real N profile and increase the accuracy in determining distances
to artificial satellites using satellite laser and radio systems. Figures
2, tables 1; references: 2 Russian, 1 Western.
[359-5303]

ACCURACY OF LASER MEASURING SYSTEMS WHEN WORKING IN TURBULENT ATMOSPHERE

[Article by V. V. Vinogradov, Moscow Institute of Land Surveying Engineers,
and A. S. Medovikov, Moscow Institute of Geodetic, Aerial Mapping and Car-
tographic Engineers, "Accuracy of Laser Measuring Systems When Working in
a Turbulent Atmosphere"]

[Abstract] The authors give an evaluation of the influence of the turbulent
character of the atmosphere on the accuracy in operation of a laser system
for determining directions in the absence of direct optical visibility and

on the accuracy of laser leveling. A thorough theoretical and experimental analysis of the problem is presented with examination of the great number of natural and physical factors involved and instrumental considerations. It is shown that in the case of highly precise geodetic work in order to reduce refraction to a minimum observations must be made at times of inversion of the radiation balance in which the vertical temperature gradient has a minimum value. The most advantageous time for observations with respect to the influence of refraction is at the same time the most advantageous with respect to the influence of turbulence, as is entirely natural because these two phenomena are physically interrelated. Accordingly, it follows that when measurements are made at a time of quiet images there will be a minimum of the errors caused both by refraction and by turbulence and this corresponds to conditions of weak turbulence. Figures 9; references: 7 Russian.

[359-5303]

ACCURACY OF RANGEFINDER MEASUREMENTS IN TURBULENT ATMOSPHERE

[Article by B. T. Fedosov, Rudny Industrial Institute, "Accuracy of Pulsed-Light Rangefinder Measurements in Turbulent Atmosphere"]

[Abstract] Measurement accuracy is one of the principal characteristics of a pulsed-light rangefinder, determining its effective range. A number of factors influence measurement accuracy. Evaluation of the accuracy in registry of the phase difference and the influence exerted by fluctuations of the refractive index of the medium on the effective range are two factors which are among the least studied and which constitute the subject of this article. Specifically, the author examines the influence of broadening of light beams in a turbulent atmosphere with absorption on the effective range of instruments with passive and active reflectors. It is shown that in the real atmosphere a system with active response gives as a minimum a twofold gain in the effective range. For instruments in a passive regime having a relatively low effective range, and vice versa, a quite considerable effective range, the gain in a medium with attenuation tends to two. In the intermediate region the gain can attain considerable values and the width of this region is determined by medium transparency. It is possible to evaluate the deterioration of real response and the increase in the mean square measurement error caused by fluctuations of the measured and background light fluxes. The article gives an algorithm for the processing of the received signal, making it possible to decrease the mean square error for measurements in the turbulent atmosphere. Formulas are given for ascertaining the effective range of a pulsed-light rangefinder with a passive reflector and for an active system. Figures 6; references 8: 7 Russian, 1 Western.

[359-5303]

ARCTIC AND ANTARCTIC RESEARCH

INTERPRETATION CF RADAR IMAGES OF SEA ICE

[Article by V. Yu. Aleksandrov and V. S. Loshchilov, "Interpretation of
Radar Images of Sea Ice Using an Electronic Computer"]

[Abstract] Difficulties in the process of visual interpretation and the
great volume of collected information makes it necessary to develop meth-
ods for the computer interpretation of radar images of sea ice. This ar-
ticle presents some results of investigations in this field, especially an
algorithm which makes it possible to carry out computer interpretation and
the results of its experimental checking. The described algorithm makes it
possible to classify ice of different age and state on the radar image, as-
signing ice to each of the following classes: 1) water, 2) gray-white ice,
3) white ice, 4) one-year ice, 5) ground and hummocked one-year ice, 7)
polar ice (over 2 years old). The algorithm involves the following: 1)
a standard image area is selected for each of the enumerated types of ice,
measurements are made of the optical density of the image and their histo-
gram is computed; 2) the optical densities are measured on a photograph
with an unknown type of ice and their histogram is computed; 3) the histo-
gram is compared with the standard and the type of ice to be determined is
assigned to the class whose measure of closeness to the standard histogram
is minimum. Three types of closeness were employed. Investigations demon-
strated the effectiveness of the algorithm. The method, described here in
detail, can be used in the interpretation not only of radar images of sea
ice, but also for aerial photographs, thermal images, etc. The applicabil-
ity of the method is not confined to ice alone; it can be employed in inter-
preting images of the sea surface and determining the type of cloud cover
or soil. Figures 3, tables 1; references 3: 2 Russian, 1 Western.
[367-5303]

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